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# Space and Light

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Experimental space and light exercises in architecture education

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## Synopsis

This paper examines the relationship between light, its effects, and architecture and visual arts. It demonstrates a series of experimental exercises conducted by the Department of Graphics, Form and Design at the Budapest University of Technology and Economics (BME), which focus on the role of light in architecture and aim at the integration of light in the complex design toolset of architecture students. With the help of experimental artworks on the borderline between architecture and fine arts, students learn how light transforms space, initiates and defines spatial interactions, and how it influences the ambience and the dynamics of the space. In the process, students acquire techniques for the effective representation of complex lighting effects in architectural interiors.

**Key words:** Space and light, lighting design, design methodology, architectural composition, interior design.

## 1. Use of Light in Visual Arts – Historic Overview

Since the time of the first erected structures in the history of human civilization, light has had a unique place in architecture. While natural light is essential to the human circadian regulation and the psychological well-being, it is also fundamental to the visual experience. It enables humans to appreciate their surroundings, to perceive colours and spatial depth, as well as architects to define the character and to communicate the general feel, emotion, ambiance and temperature of a space.

As structural innovations allowed for larger, more flexible and versatile openings on buildings, light has become a design tool itself. From the Roman Pantheon to Tadao Ando's Church of Light, architects have not only incorporated the effects of sunlight into their interiors, but also designed entire buildings around a specific light feature of light phenomenon. Whether it is natural, or artificial, directed or diffuse, static, dynamic or kinetic, sharp, obscure or opaque, white or coloured, warm or cold, light has the ability to embellish a simple space, often in more varied ways than any physical structure.

With the emergence of photography, other fields of visual arts quickly adopted light into their toolset. László Moholy-Nagy, Man Ray, Christian Schad were among the first painters to experiment with photosensitive surfaces, which replaced the traditional canvas in their photograms. At the New Bauhaus school in Chicago, György Kepes, the head of the Colour and Light Department, created camera-less light graphs. As electric incandescent lighting became safe and affordable, possibilities expanded enormously, and artists of the Modernism began using light as the main form of expression, rather than solely as a vehicle for other forms of art. Marcel Duchamp and Naum Gabo were pioneers of creating sculptures from shadows and reflectance. Nicholas Schöffer's cybernetic creations, Wen-Ying Tsai's stroboscopic light sculptures, Ellis D Fogg's lumino-kinetic artworks are just a few examples of how artists of the op art embraced light. Neon lighting is the main feature in the works of several artists, including Victor Millonzi, Dan Flavin, Gyula Košice, or more recently by Michael Hayden or Lili Lakich. Projection mapping and light graffiti transform the static walls of existing buildings into the display surface of moving light creations.

## 2. Light as a Design Tool in Architecture Education

In parallel with the process of visual and industrial artworks becoming an integral part of contemporary interiors – as opposed to serving merely as decoration - lighting as an artistic instrument has also gained an unprecedented momentum. Despite its powerful capabilities as a design tool, however, the role of lighting is often underrepresented in general academic architecture education, with lighting design mostly limited to specialized master programs. The BME Department of Graphics, Form and Design has conducted a series of exercises in the field of light studies in dedicated courses for both in its Bachelor and Master program architecture, over more than a decade. These courses follow an effective perception development methodology that revolves around the systematic interpretation of the nature and characteristics of light, the different lighting phenomena, and various optical effects through a series of



tentative scale models, with the prospect of the adoption of the findings into architecture design. The following section introduces a few of the several light exercises conducted in the frame of this comprehensive and long-running research process.

### 3. Light Exercises

Largely inspired by the above artists and fields of light art, the exercise titled *'Light Modulator'* introduces students and different filters of altering light, shadow and the perception of the lit surface. Using light as a paintbrush, students create abstract compositions, while experimenting with transcendent and genuine light effects, and their in-between transitions. At the beginning of the project, students learn the basics of light photography, the physical attributes of light, and they set up their own makeshift studio, using simple objects - emitting, filtering or reflecting light - found in their home or learning environment. They examine how these objects alter the way light appears on and around them, and learn – often as an accidental result of their experiments – how to achieve the desired effects. The course teaches them how to capture light in motion, and, implementing the above effects, they create conscious graphical compositions (Fig. 1).

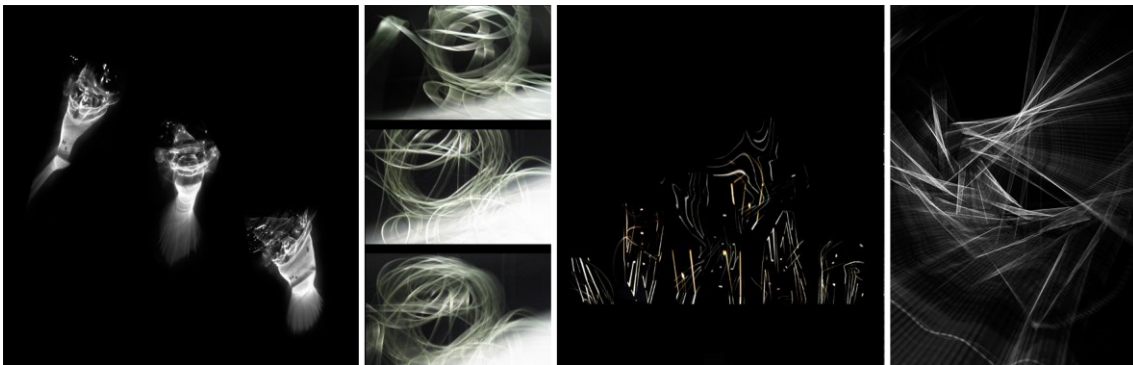


Figure 1.

The catchphrase *'Positive – Negative'* (Fig. 2) marks another exercise and a step forward, in which students learn and examine the compositional principles and proportional systems of avant-garde artworks and create compositions by elevating their own planar interpretations based on the same principles into space, thus transforming the abstract compositions into architectonic structures. Juxtaposing their composition and its negative outline, they experiment with the interplay of the constellation and light. Contrast between the spatial object and the surface, the counterpointing reflections and shadows contribute to a complex compositional harmony.

*'Space and Light'* is the collective title of a series of exercises in which students build simple tentative architectural interior models and analyse lighting scenarios from aesthetic and compositional aspects. They learn about the fundamental compositional principles of physical manipulation techniques like folding, corrugation, or perforation, in order to create interiors that are adoptive to light and lighting effects. Then, employing the toolset they acquired in the course of previous projects, they start experimenting with scattered and directed light;

examine the effects of different types of perforations, surface textures, the tonal transition of shadows, and learn about the role of backlighting, the proper use of linear and area lighting contrasts, and the aerial perspective. Students recreate the complex lighting effects of transparent and translucent structures and materials found in contemporary architecture: they form transcendent quasi-spaces with the help of volumetric lighting effects (Fig. 3).

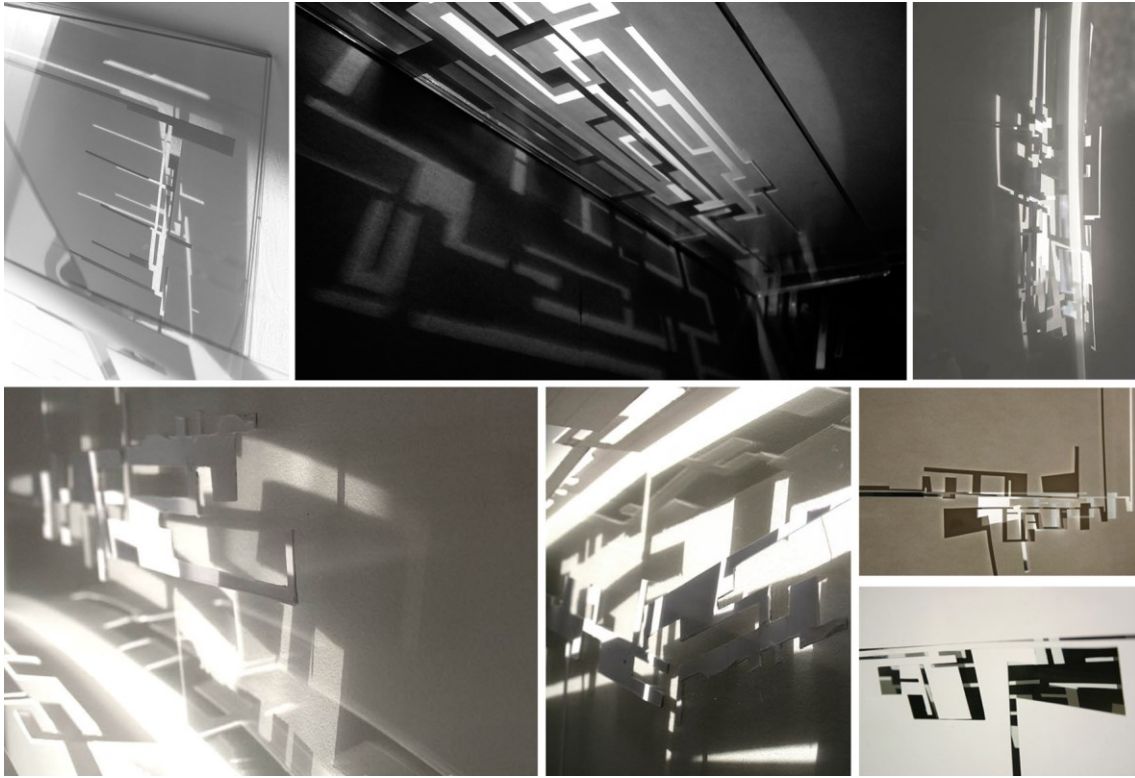


Figure 2.

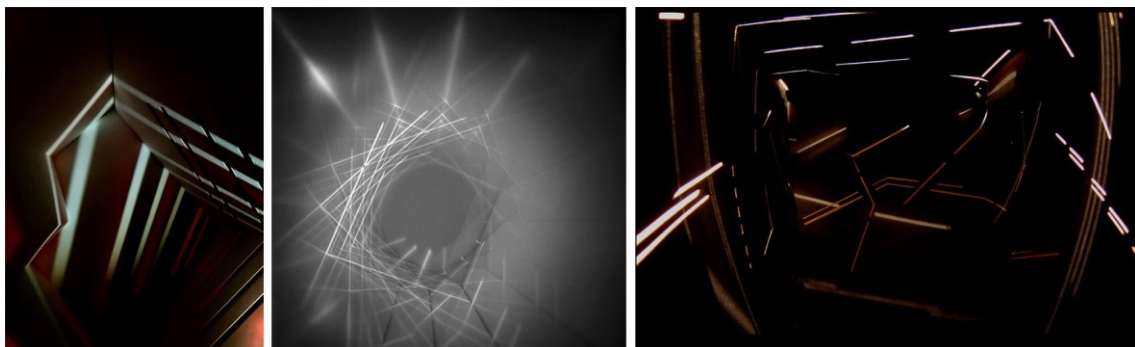


Figure 3.

Part of the project is to understand how the shape of the model interior, the applied materials, textures, and surface modifications contribute to the lighting effect, and, from the other perspective, how light forms the way we perceive the interior. From a teaching point-of-view, the challenge is to ensure a conscious, goal-oriented development process. Students need to be able to define the desired outcome before the experiments, while lecturers help by defining the appropriate tools and multiple potential directions while leaving enough room for creative trials. Students photograph the finished model from a human-scale point-of-view (Fig. 4).

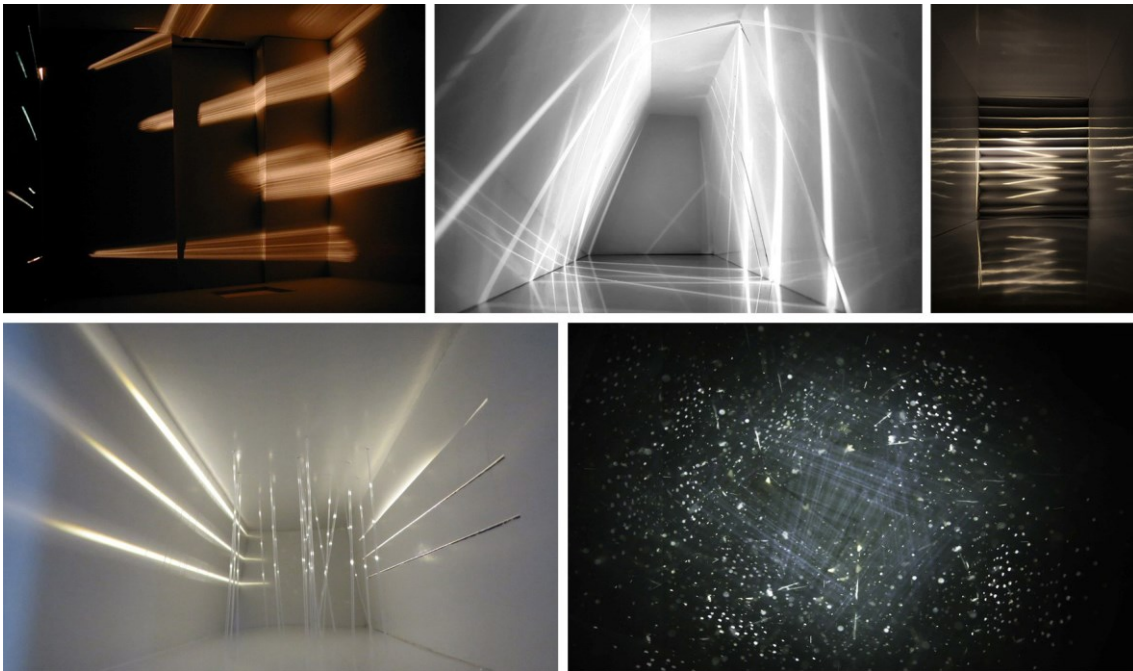


Figure 4.

The project concludes with a light-path study - animations using natural and artificial light sources to examine the versatility of lighting conditions or the path of the sun.



Figure 5.

#### 4. Conclusions

Light has been a very powerful instrument in architecture and visual arts. In contemporary architecture, spaces become undefined and versatile; the enveloping surfaces convert into tools for impression and expression: virtual displays of an interactive experience. The static physical boundaries give way to dynamic features. The flexibility and complex expressive power of light makes it an invaluable design tool in architecture. Over the recent years, these light exercises have proved to not only help develop students' understanding of the

complex relationship between light and space, but also enhance their visual sensitivity. Following a strategic methodology, these experiments have enabled students to extend their compositional skills on the borderline of art and architecture, and further develop their visual representational toolsets. Adopting these techniques, they have been able to use light as a conscious and deliberate design tool for the expression of more complex and refined architectural interiors. At the same time, the teaching of these courses and the developed techniques have been a great source of inspiration and have led to several other research and art projects at the department.

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## Biography

**Portschy Szabolcs.** A full-time lecturer of architecture design and architectural graphics at the Budapest University of Technology and Economics (BME) for ten years, and is currently a PhD student at the University of Pécs. He holds a Master's degree in Architecture and second Master's in Economy. He was a Fulbright scholar to UC Berkeley in 2007-2008. His primary research covers two distinct areas, teaching methodologies of community participatory architectural design, as well as traditional and hybrid architectural graphics. He was the director of an experimental community design studio at BME between 2008 and 2013.